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The use of MCQs within Team Based Learning: choosing the right approach to foster student learning.

Dr Venetia Brown, Dr Kevin Corbett, Iqram Serroukh

Deciding to use TBL

- Attending a conference
- Making connections
- Opportunity to see how it works
- Recruiting interest
- Limitations of current research methods module/approach to teaching (Nursing)



What is TBL?

- Is not Problem Based Learning (PBL)
- Structured approach with a core pedagogic philosophy around benefits of learning in teams
- Developed by Michaelsen in USA and was originally used in Business Studies



How does TBL work?

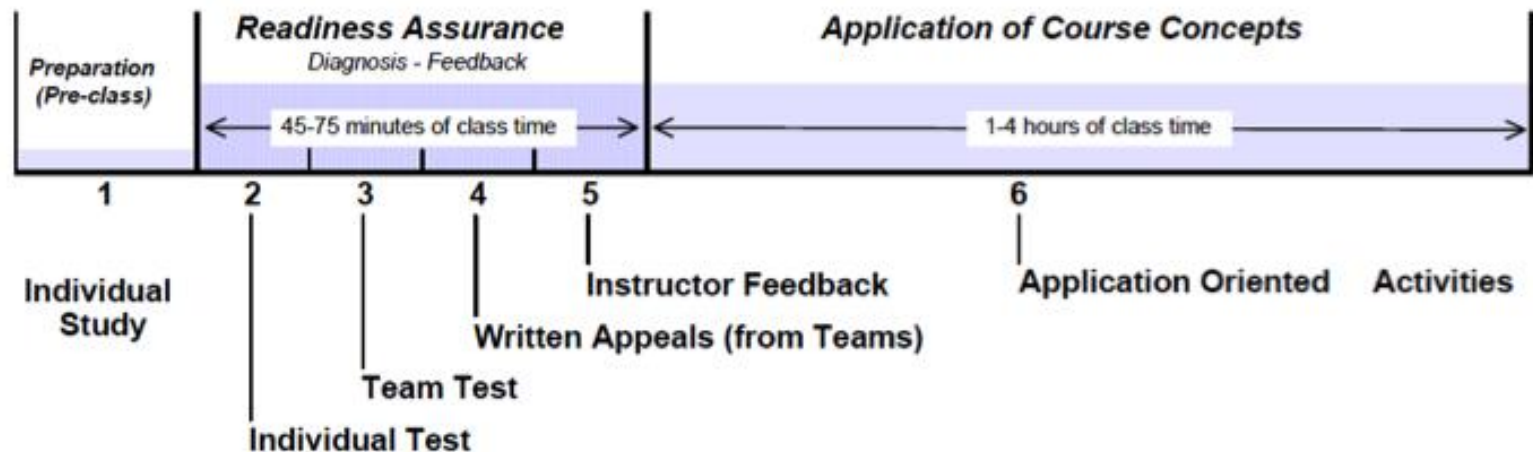
- TBL utilises a small group approach with a large number of students (200+)
- Groups are structured and comprise of approximately 5-7 students and remain permanent
- Only one facilitator is needed

3 Phase Cycle

- Preparation
- Readiness Assurance
- Application of Course Concepts

Team-Based Learning Instructional Activity Sequence

(Repeated for each major instructional unit, i.e., 5-7 per course)





Phase 1 - Preparation

- Students are assigned pre-reading materials
- Expected to actively engage with these before the sessions
- This reading time is timetabled into the module
- The learning materials are available electronically on Moodle
- Resources have clear objectives



Phase 2 - Readiness Assurance (i)

- Purpose of RAP- higher order learning
- Individual Readiness Assurance Test (i-RAT)
- Short closed book MCQ based on the readings
- Summative
- Weighted at 70%

Readiness Assurance (ii)

- Team Readiness Assurance Test (t-RAT)
- Students repeat the same test as a team
- They are supplied with IF-AT cards and discuss the answers as a group
- Awarded points (4pts, 2pts, 1pt, 0pts)
- The discussion develops critical thinking and other competencies
- Weighted at 30%

IMMEDIATE FEEDBACK ASSESSMENT TECHNIQUE (IF AT®)
Name Team #3 Test # 2
Subject _____ Total _____
SCRATCH OFF COVERING TO EXPOSE ANSWER

	A	B	C	D	Score
1.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	4
2.	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	2
3.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	4
4.	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	1
5.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
6.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
7.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
8.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
9.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
10.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

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Phase 3: Application of Course Concepts

- 4 S's

Significant Problems

Same Problem

Specific Choice

Simultaneous Reporting

- Deep understanding comes from cognitively engaging with the course concepts in the application activity

Use of MCQs in the Readiness Assurance Process

Aim of the RATs

- Individual accountability for pre-class prep.
- Vocabulary and major concepts needed for problem solving which take place in the application activity.
- Social dialogue and peer teaching
=>deeper shared understanding and consensus

The challenges and benefits of different approaches to the MCQ tests

MCQs may indicate....

(Burton, 2002, p806)

- **Full knowledge** of a test item (enough to give a confident and correct response)
- **Partial knowledge** (raises the probability of making a correct guess) Incomplete information or lack of confidence in own knowledge

MCQs may indicate....cont'd

- **Misinformation** leading to incorrect answers that are not guesses
- **Distrusted knowledge** (correct knowledge that is not trusted)
- **Distrusted misinformation** (incorrect knowledge that is not trusted)

General arguments about MCQs

- Surface not deep learning, inability to develop an argument, tendency to perform better than in essay type exams.
- But Bush (2001, p.157) argues can they can assess cognitive, analytical and other high level skills as well as factual knowledge.

MCQ test options



Number right/ right scoring

- Guessing may be blind but may also be on the basis of partial knowledge where students gamble on hunches.
- Does not penalise misinformation.
- Does not penalise no knowledge
- Does not reward partial knowledge
- Guesswork rewarded



Number right + negative marking.

- Used to deter students from blind guessing and to minimise the ‘unfairness associated with the vagaries of un-penalised guessing’ (Burton 2005, p69)
- Penalises misinformation/incorrect responses
- Penalises bad guesses
- May also penalise no knowledge



Number right elimination testing (NRET) scoring method

- Focus: active elimination of wrong options and identification of one option as the correct answer or “not sure” for any option.
- The scoring for NRET for any MC item with four options
 - One point is awarded for each wrong option correctly eliminated.
 - Penalty of three points is deducted if the correct answer is eliminated.
 - One additional point is awarded if the answer chosen is correct,
 - No point are given for choosing “not sure.”

Confidence marking

- Indication of confidence in knowledge
- Dory et al (2010) argue that for doctors it is important for them to know about knowing = **metacognition**.
- Could be argued that this is true for all HCPs.

Confidence marking

- MCQs – **confidence score** used as distinct measures from the **test score**
- Provides information beyond the percentage of correct answers
- Allows teachers *and students themselves* to gauge their overall level of:
 - **partial versus certain knowledge** and
 - **ignorance versus hazardous misconceptions.**

- Resulting in.....
 - Usable knowledge (correct answers where highly confident)
 - Hazardous ignorance (wrong answers where highly confident)

-

Which approach should we use? Issues in healthcare education

- Guessing not to be encouraged in healthcare context.
- Certainty of limits of knowledge is desirable
- Provides markers with info on misinformation
- Concerns about hazardous ignorance/usable knowledge and its appropriateness for healthcare practitioners.
- But bias problem: minimise risk taking (hedge bets) and test wiseness. Not an indicator of true performance/accountability

Activity progression via Bloom's levels

Levels	i-RAT	t-RAT	Application exercises
Creating			
Evaluating			
Analysing			
Applying			
Understanding			
Remembering			

- Focus shifts from learning course concepts to learning how to apply concepts to cases & the instructional sequence moves to higher Bloom's levels as students progress over the module.
- Initial acquisition of core knowledge in RATs as students progress via Remembering, Understanding levels.
- Application exercises move students through Analysing, Evaluating and Creating levels.
- Whole class discussions after Simultaneous Report in Application Activity help students articulate/examine own thinking and varied perspectives arriving at verifiable version of optimal solution. (From 'Team-Based Learning. Student Study Guide', University of Bradford, U.K.)

Immediacy of feedback - 1

- TBL uses MCQ pedagogy via question design
- MCQ design:
 - Item stem
 - Lead in question
 - Answer + distractor
- Frequent/timely feedback is given to students

Immediacy of feedback- 2

- TBL uses MCQ pedagogy via repeated tests to give immediate feedback:
 - i-Rat
 - t-RAT

Higher scores correlate with TBL

- A systematic review by Sisk (2012) showed the increase in knowledge scores could not be attributable to either:
 - TBL
 - course content
- Methodological deficits in TBL research e.g. lack of randomization and control groups

Higher knowledge scores with TBL

Haberyan (2007) found an increase in **knowledge scores** from pretest to posttest (organizational psychology).

TBL was evaluated in a continuing medical education program in a pretest-posttest design study of 165 continuing medical education program participants in Germany (Kühne-Eversmann, Eversmann, & Fischer, 2008). **Knowledge test scores increased significantly** from the beginning to the end of the course, and students rated TBL as an effective method of learning.

McInerney and Fink (2003) demonstrated a **significant increase in final examination scores** in their study of an undergraduate microbial physiology course when the full TBL method was used.



More Participation, Less Enjoyment

Mean Differences (\pm SD) in Engagement Between the Groups

Value	Nursing Pharmacology (Control, N = 67)	Case Management (Team, N = 51)	tTest	p
Total score	29.0 (5.2)	28.6 (6.1)	0.36	NS
Participation	17.5 (3.2)	18.9 (3.6)	-2.23	< 0.03
Enjoyment	11.4 (2.3)	9.7 (3.1)	3.06	< 0.001

Note. NS = not significant.

Clark et al (2008)
“TBL in an undergraduate nursing course”



Positive (static) attitudes towards teams

Pretest and Posttest Differences in Value of Teams, and

Peer and Working in Group Subscales

Value	N	Mean Pretest Score (\pm SD)	Mean Posttest Score (\pm SD)	Mean Difference (\pm SD)	t Test	p
Total	50	32.4 (6.9)	31.2 (5.6)	1.16 (6.6)	1.23	NS
Peer	51	15.4 (3.2)	15.0 (2.6)	0.33 (3.3)	0.73	NS
Group	51	17.0 (4.1)	16.3 (3.5)	0.70 (4.2)	1.19	NS

Note. NS = not significant.

Clark et al (2008)
“TBL in an undergraduate nursing course”

Dissatisfaction with peer evaluation

“Satisfaction with Peer Evaluation - A comparison of overall mean scores for statements in this category suggests that students’ responses to statements about peer evaluation fell primarily in the “mixed opinion” range. Students’ **attitudes about their satisfaction with peer evaluation tended to decline** from the first year of medical school to the second year. Statistically significant declines in students’ attitudes were noted for the role of peer evaluation in motivating a student to work harder and/or more collaboratively, **as well as for how well students liked the use of peer evaluation. No statistically significant change was noted in students’ attitudes toward their peers being fair regarding their judgment of students’ contributions to a team. “**

Parmelee et al (2009)

‘Medical students’ attitudes about team based learning in a pre-clinical curriculum’.

Conclusions – (i)

TBL associated with:

- increased knowledge scores
- better exam scores for some less able students (Koles et al 2005)
- positive attitude to attitude towards teams & participation

TBL associated with:

- negativity towards, or dissatisfaction with, peer evaluation
- less enjoyment (fear of missing content) (Clark et al 2008)

Conclusion (ii)

- Accountability – taking responsibility and contributing to team success
- Judgement – dialogue and debate within and between teams => lessons learned about judgment
- Judgement – foundation for clinical reasoning (Parmelee, 2008)